

5                   **SYSTEM AND METHOD FOR RESUMING PLAYBACK**

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**CROSS-REFERENCE TO RELATED APPLICATIONS**

**[0001]** Pursuant to 35 U.S.C. § 119(a), this application  
claims the benefit of earlier filing date and right of Korean Patent  
15 Application No. 10-2003-21251, filed on April 4, 2003, the content  
of which is hereby incorporated by reference herein in its entirety.

**BACKGROUND OF THE INVENTION**

**Field of the Invention**

20                   **[0002]** The present invention relates to a recording medium  
for recording data streams. A title domain, menu domain and  
navigation information for control of reproduction of data streams  
are provided to control playback of a title from a preselected  
resume position.

25                   **Description of the Related Art**

**[0003]** An optical disk is capable of storing video data with  
a high- quality picture and audio data with high-quality sound  
thereon. A digital versatile disk (DVD) is an example of such  
optical disk. An optical disk apparatus, such as a DVD player, is  
30 capable of reproducing data streams recorded on the DVD and is widely  
commercially available.

**[0004]** An exemplary embodiment of such an optical disk

apparatus is illustrated in Fig. 1. The optical disk apparatus comprises an optical pickup 11, a video disk play (VDP) system 12, a processor 13 and a memory 14. The processor 13 controls the operation of the VDP system 12 in response to a user's request to play an optical disk 10 loaded in the apparatus. Recorded on the optical disk, (e.g., the DVD), are data streams of a title domain and menu domain. Navigation information for control of reproduction of the data streams are also recorded thereon.

**[0005]** Referring to Fig. 2, the navigation information includes program chain command table information (PGC\_CMDTI), a plurality of pre-commands (PRE\_CMD#1-PRE\_CMD#i), a plurality of post-commands (POST\_CMD#1-POST\_CMD#j) and a plurality of cell commands (C\_CMD#1-C\_CMD#k), which are recorded and managed in a program chain command table (PGC\_CMDT).

**[0006]** The program chain command table information PGC\_CMDTI includes information PRE\_CMD\_Ns about the number of the pre-commands, information POST\_CMD\_Ns about the number of the post-commands and information C\_CMD\_Ns about the number of the cell commands. The title domain includes a plurality of titles, each of which has a plurality of system parameters SPRMs in which information recording fields 0 to 23 SPRM0-SPRM23 are respectively assigned as shown in Fig. 3.

**[0007]** A title number for the title domain is recorded in the field 4 SPRM4. A video title set title program chain number for the title domain is recorded in the field 5 SPRM5. A title program chain number for the title domain is recorded in the field 6 SPRM6. A part-of-title number for one sequential program chain

title is recorded in the field 7 SPRM7. A highlighted button number for a selection state is recorded in the field 8 SPRM8. The information recording fields 21 to 23 SPRM21-SPRM23 are reserved.

5           **[0008]**   The optical disk apparatus performs a series of data reproduction operations corresponding to the user's request by searching for and referring to the navigation information recorded and managed in the above-mentioned manner. An optical disk system for recording data streams of a title domain with a main title  
10 and bonus video titles and data streams in a menu domain including a root menu is needed to support various contents, such as games. An efficient resume function for seeking and playing a predetermined position of a specific title when a playback operation is returned from the menu domain to the title domain  
15 is also needed.

#### **SUMMARY OF THE INVENTION**

**[0009]**   In accordance with one embodiment of the invention, a recording medium comprises a first recording area for recording data streams of a title domain and menu domain, said title domain  
20 comprising a plurality of titles; and a second recording area for recording navigation information for control of reproduction of the data streams, wherein the navigation information in the second recording area comprises playback control information for designating a location in the title domain to be resumed.

25           **[0010]**   The playback operation is resumed from the menu domain to the title domain and the navigation information further

comprises a resume command for resuming the playback operation to the title, and wherein the resume command is recorded and managed in a program chain command table, command information about number of resume commands. The command information is  
5 recorded and managed in said program chain command table.

**[0011]** The title may comprises a plurality of system parameters, in certain embodiments. The system parameters comprise identification information indicating that the title is resumable. At least a second title in said title domain comprises  
10 a plurality of system parameters. The system parameters of the second title comprises identification information indicating that the second title is nonresumable. The system parameters are assigned values associated with at least one of a title cell number, a video title set number, a navigation pack start address and  
15 program chain playback control status information, for example.

**[0012]** A method for controlling playback of audio/video data recorded on a recording medium is provided, in accordance with one embodiment. The method comprises searching for and confirming first playback control information for designating a  
20 first title in a title domain having system parameters comprising identification information indicating that the first title is resumable, in response to a playback operation returning from a menu domain to the title domain, the title domain comprising a plurality of titles; and seeking and playing a first position of  
25 the first title corresponding to the first playback control information.

**[0013]** In some embodiments, the first playback control

information comprises a title cell number, the first playback control information comprises a video title set number. The first playback control information comprises a navigation pack start address and comprises program chain playback control status  
5 information. The program chain playback control status information designates the first position of the first title.

**[0014]** In certain embodiments, the method further comprises updating the first playback control information with a second playback control information by execution of a program chain  
10 command of one of the plurality of titles in the title domain, played before data streams of the menu domain are reproduced. And, updating the first playback control information with a second playback control information for designating the first position of the resumable first title by execution of a program chain  
15 command.

**[0015]** In one or more embodiments, the first playback control information is updated with a second playback control information by execution of a program chain command of a menu in the menu domain played at a point of time that the playback  
20 operation is returned from the menu domain to the title domain. In some embodiments, the first playback control information is updated with a second playback control information for designating the first position of the first title by execution of a program chain command of the menu domain, if one of the plurality of titles  
25 in the title domain, played before data streams of the menu domain are reproduced, is nonresumable.

**[0016]** The identification information indicates if the

first title is resumable, when the playback operation is returned from the menu domain to the title domain. The identification information is included in system parameters of each of the plurality of titles in the title domain. For example, the first recording area is a video recording area or a DVD-Video recording area. Further, the second recording area is a file structure recording area, for example.

**[0017]** In accordance with yet another embodiment, an optical recording medium comprises a DVD-Video recording area for recording data streams of a title domain and menu domain, the title domain comprising a plurality of titles; and a file structure recording area for recording playback information for controlling reproduction of the data streams, wherein said navigation information in the file structure recording area comprises at least a resume command for designating a title in the title domain, when a playback operation is returned from the menu domain to the title domain.

**[0018]** In other embodiments, a method of resuming playback of audio/video (A/V) data recorded on a recording medium is provided. The method comprises determining resumable status of a first title recorded on the recording medium, once playback of a bonus title associated with the first title is concluded; resuming playback of the first title if the resumable status is equal to a first value.

**[0019]** Playback of a second title is resumed, if the resumable status is equal to a second value. In one embodiment, the resuming step comprises determining a first playback location

associated with the first title; and resuming playback from the first playback location. The first playback location is a location associated with a location where the first title begins. Sometime, the first playback location is associated with a location other than where the first title begins.

**[0020]** The first playback location can be associated with a location where a second title begins. The first playback location is provided in a program chain command for the first title, for example, and is provided in a mapping table associated with a program chain command for the first title. A plurality of bonus titles may be associated with the first title, and wherein each of the plurality of bonus titles are associated with a respective resume command. Sometimes, in each respective resume command is associated with at least one parameter indicating whether the first title is resumable from the respective bonus title.

**[0021]** These and other embodiments of the present invention will also become readily apparent to those skilled in the art from the following detailed description of the embodiments having reference to the attached figures, the invention not being limited to any particular embodiments disclosed.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0022]** The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

**[0023]** Fig. 1 is a block diagram of an optical disk apparatus,  
in accordance with one or more embodiments;

**[0024]** Fig. 2 is an exemplary program chain command table  
of a DVD;

5 **[0025]** Fig. 3 illustrates system parameters of a DVD;

**[0026]** Fig. 4 illustrates a program chain command table of  
a recording medium, according to one embodiment of the present  
invention;

**[0027]** Fig. 5 illustrates exemplary system parameters of a  
10 recording medium according to one or more embodiments;

**[0028]** Figs. 6 and 7 illustrate a method for controlling  
playback of the recording medium content according to one or more  
embodiments; and

**[0029]** Figs. 8 and 9 illustrate an alternative method for  
15 controlling playback of the recording medium content according  
to another embodiment.

**[0030]** Features, elements, and aspects of the invention that  
are referenced by the same numerals in different figures represent  
the same, equivalent, or similar features, elements, or aspects  
20 in accordance with one or more embodiments of the system.

#### **DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

**[0031]** In accordance with one embodiment of the invention,  
data streams of a title domain such as a main title and bonus video  
titles, can be recorded on a recording medium, such as an optical  
25 disk or DVD. Data streams of a menu domain, including a root menu,  
are also recorded to support various contents such as games.



**[0032]** The present invention, in accordance with one or more embodiments is described, by way of example, as applicable to optical disk mediums, such as DVD or CD ROM. This application and exemplary embodiments, however, shall not be construed as  
5 limiting the scope of the invention to said recording mediums, only. The systems and methods disclosed herein may be used in conjunction and apply to any recording medium, such as a hard drive, magneto-optical or magnetic recording mediums, memory stick devices, and other functional equivalents.

10 **[0033]** In accordance with one or more embodiments, navigation information for control of reproduction of the data streams are recorded on the optical disk. For example, as shown in Fig. 4, the navigation information may include program chain command table information PGC\_CMDTI, a plurality of pre-commands  
15 PRE\_CMD#1-PRE\_CMD#i, a plurality of post-commands POST\_CMD#1-POST\_CMD#j and a plurality of cell commands C\_CMD#1-C\_CMD#k, which are recorded and managed in a program chain command table PGC\_CMDT. According to one embodiment of the invention, the navigation information further comprises one or  
20 more resume commands RSM\_CMD#1-RSM\_CMD#k.

**[0034]** In certain embodiments these or other control information are also recorded and managed in the program chain command table PGC\_CMDT or another equivalent data structure. Each resume command, for example, is an algorithm that indicates  
25 how playback will be resumed. The program chain command table information PGC\_CMDTI may comprise information RSM\_CMD\_Ns indicating the number of the resume commands. Information

PRE\_CMD\_Ns about the number of the pre-commands, information  
POST\_CMD\_Ns about the number of the post-commands and information  
C\_CMD\_Ns about the number of the cell commands may be also included,  
in some embodiments.

5       **[0035]**   The title domain comprises a plurality of titles,  
each of which has a plurality of system parameters SPRMs in which,  
for example, 26 information recording fields 0 to 25  
(SPRM0-SPRM25) are respectively assigned, as shown in Fig. 5. A  
title number for the title domain is recorded in the field 4 SPRM4,  
10   for example. A video title set title program chain number for  
the title domain is recorded in the field 5 SPRM5, for example.

**[0036]**   A title program chain number for the title domain is  
recorded in the field 6 SPRM6, a part-of-title number for one  
sequential program chain title is recorded in the field 7 SPRM7,  
15   and a highlighted button number for selection state is recorded  
in the field 8 SPRM8, for example, in one or more embodiments.

**[0037]**   Recorded in the fields 21 to 25 (SPRM21-SPRM25) is  
playback control information for a resume function. The resume  
function may be for seeking and playing a predetermined position  
20   of a specific title when a playback operation is returned from  
the menu domain to the title domain during execution.

**[0038]**   For example, a title cell number for the title domain  
may be recorded in the field 21 (SPRM21), a video title set number  
in the field 22 (SPRM22), a navigation pack start address for the  
25   title domain in the field 23 (SPRM23), and program chain playback  
control status information in the field 24 (SPRM24).

**[0039]**   In one embodiment, the field 25 (SPRM25) comprises

a resumable flag indicative of whether the corresponding title is resumable. For example, in the case where the flag is set to '1', it indicates that the corresponding title may be selected or played when the playback operation is returned from the menu domain to the title domain. Alternatively, in the case where the flag is set to '0', it indicates that the corresponding title may not be selected or played when the playback operation is returned from the menu domain to the title domain. In certain embodiments, if the flag indicates that the title is resumable, then the playback control information stored in the fields 21 to 25 is not changed or set. In other embodiments, the playback control information is modified in accordance with whether the title is resumable or not.

**[0040]** Now, a method for controlling playback of the optical disk based on the resume function is provided. The resume function is for seeking and playing a predetermined position of a specific title when the playback operation is returned from the menu domain to the title domain during its execution. The resume function references playback control information recorded in the program chain command table PGC\_CMDT and the playback control information recorded in the information recording fields.

**[0041]** The optical disk playback control method according to the present invention can be applied to a general optical disk apparatus or the exemplary optical disk player apparatus of Fig. 1. In one embodiment, the optical disk apparatus may play a bonus video title in response to a user's request or on the basis of navigation information. The playback may take place in the middle

of playback of a movie of the main title, for example. The resumable flag in the field 25 (SPRM25), among the system parameters of the main title, can be set to indicate that the main title is resumable or not.

5       **[0042]** Referring to Fig. 6, the resumable flag is set to '0' to indicate that a first bonus video title is nonresumable. The optical disk apparatus may jump to the root menu in the menu domain of the optical disk to play it in response to a user's request. In this case, a resume command Bonus Video1 RSM\_CMD of the first  
10 bonus video title is executed. At this time, for its returning from the menu domain to the title domain, the optical disk apparatus sets and stores a predetermined position of a specific title, for example, the main title with its flag set to '1' as resume information, RSM\_Info. for Movie, therein.

15       **[0043]** That is, when a user jumps from the first bonus video title to the root menu, the system parameters in the fields 4 to 8 (SPRM4-SPRM8) and the fields 21 to 24 (SPRM21-SPRM24) of the main title, for example, are stored in the optical disk apparatus as resume information RSM\_Info. for designating the predetermined  
20 position of the main title.

**[0044]** If the user selects a resume button during the playback of the root menu, then the optical disk apparatus performs a playback control operation based on the resume function of seeking and playing the predetermined position of the main title  
25 designated by the stored resume information, by searching for and referring to those system parameters. Accordingly, when the resume function is performed from the root menu to the title domain,

the playback operation causes the system to jump, not to the first bonus video title, but directly to the predetermined position of the main title corresponding to the resume information stored by execution of the resume command of the first bonus video title.

5 Therefore, the optical disk apparatus can rapidly play the predetermined position of the main title, such as a movie.

**[0045]** In an alternative embodiment of the present invention, in the case where the optical disk apparatus jumps to the root menu in the menu domain of the optical disk in response to the user's request, information Position\_Info about the current

10 playback position of the first bonus video title is set and stored.

**[0046]** In some embodiments, if the user selects the resume button during the playback of the root menu, then the optical disk apparatus executes a resume command (Root Menu RSM\_CMD) of the

15 root menu. At this time, the optical disk apparatus checks the resumable flag in the field 25 (SPRM25), among the system parameters of the first bonus video title corresponding to the position information.

**[0047]** If the checked flag indicates that the first bonus

20 video title is nonresumable, the system parameters in the fields 4 to 8 (SPRM4-SPRM8) and the fields 21 to 24 (SPRM21-SPRM24) of the main title are set and stored as resume information for designation of a predetermined position of the main title by execution of the resume command of the root menu.

25 **[0048]** The optical disk apparatus then performs a playback control operation based on the resume function of seeking and playing the predetermined position of the main title designated

by the set resume information. As a result, the resume function is performed from the root menu to the title domain. And, the playback operation starts not from the first bonus video title, but directly from the predetermined position of the main title.

5 As such, the optical disk apparatus can quickly play the predetermined position of the main title, such as a movie.

**[0049]** The present invention provides an optical disk and a method for controlling playback thereof, wherein a content provider that provides various contents, such as games, can  
10 efficiently provide titles with various scenarios by designating the titles as resumable or nonresumable. When a resume operation is performed, an optical disk apparatus can more rapidly play a predetermined position of a specific title, such as a movie.

**[0050]** The embodiments described above are to be considered  
15 in all aspects as illustrative only and not restrictive in any manner. Thus, other exemplary embodiments, system architectures, platforms, and implementations that can support various aspects of the invention may be utilized without departing from the essential characteristics described herein. These and various  
20 other adaptations and combinations of features of the embodiments disclosed are within the scope of the invention. The invention is defined by the claims and their full scope of equivalents.